EFFECT OF SHEAR REINFORCEMENT TO REINFORCED CONCRETE BEAM BEHAVIOR

HASHEM TALAL HADI AL-HAMED

B. ENG(HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

EFFECT OF SHEAR REINFORCEMENT TO REINFORCED CONCRETE BEAM BEHAVIOR

HASHEM TALAL HADI AL-HAMED

Thesis submitted in fulfilment of the requirements

for the award of the

Bachelor Degree in Civil Engineering

Faculty of Civil Engineering and Earth Resources

UNIVERSITI MALAYSIA PAHANG

JANUARY 2019

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of B. Eng (hons.) Civil Engineering

_____

(Supervisor's Signature)

Full Name : DR.FADZIL BIN MAT YAHAYA

Position : LECTURER

Date : 14/1/2019

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : HASHEM TALAL HADI AL-HAMED

ID Number : AA14270

Date : 14/1/2019

ACKNOWLEDGEMENTS

In the name of Allah SWT, most Grateful and most Merciful, All the praise and thanks are to Allah SWT for giving me strength and endurance in finding my thesis. This dissertation would not have been possible without the guidance of several individuals who extended their valuable assistance in preparation and completion of this study.

My sincere gratitude to my supervisor Dr.FADZIL BIN MAT YAHAYA, who had given guidance for my work and came up with some inspiring suggestion, in the meantime, his patience in guidance me and for all his knowledge sharing, advices, enable me to develop an understanding of the subject. I also sincerely thanks to Dr FADZIL for the time spent proofreading and correcting my many mistakes. It is an honor for me to thanks for everything, sir. Also thank to all the staff that help me in many way and their excellent co-operation especially during preparation and testing sample at laboratory, with their helps and guidance I have accomplished the testing according to the time.

Lastly, I would like to express my gratitude to all dear friends and classmate especially and fellow student of Civil Engineering for their heart whelming in giving idea in many ways, and support during this study. Thank you very much to all. Hopefully this research can be shared and thus provide benefits to the needy.

ABSTRACT

The flexural strength is one of the mechanical properties of concrete. The flexural strength of concrete is needed to determine the maximum deflection and also maximum loads that concrete can maintain at certain times. Shear reinforcements, which are norally provided as vertical stirrups, are placed at varying intervals depending upon the shear conditions acting on a beam. The flexural failure in reinforced concrete beams does not happen suddenly but instead it shows some warning of distress that will occur in the near future. Contradictory to this, the shear failure is sudden, catastrophic and devastating. To avoid any such sudden shear failure, shear reinforcements are provided. Also, the shear reinforcement has a control over the shear strength of the beam. The shear stirrups and are used to increase the shear strength of concrete beams, to avoid the shear failure and to cause a flexural failure. The main aim of this research is to study the effects of shear reinforcement on flexural strength in concrete beam. The concrete mixture used in the present study consists of cement, course aggregates, fine aggregates and water. Two types of tests i.e. compressive and flexural were carried out. The samples for compressive strength included cubes with size of 150 mm x 150 mm x 150 mm, while the size of the beams used for flexural strength tests were 150 mm width x 150mm depth x 750mm length. The results show there is no difference in flexural capacity between 3 shear links and 4 shear links, but when add 5 shear links we notice slight increase in the flexural capacity, it is concluded that the addition of links as shear reinforcement slightly effect the flexural capacity.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

N/mm^2	Newton per millimetre square
kN	Kilo Newton
N	Newton
mm	Millimetre
m	Metre
MPa	Megapascal

LIST OF ABBREVIATIONS

BS EN	British Standard European Norm
ASTM	American Standard Test Method
MS	Malaysian Standard
OPC	Ordinary Portland Cement

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Beam is a structural element that firstly resists the loads applied horizontally to the beam's axis. When we apply the loads to the beam it causes reaction forces at the packet support points and this happening because the position of deviation of this beam is primarily by bending. The overall effect of all the forces acting on the beam is to produce shear forces and bending moments through the beam, this stimulates the internal stresses, strains and deflections of the beam. So, beams can be described as members that are mainly subjected to flexure and it is essential to focus on the analysis of bending moment, shear, and deflection. When the bending moment acts on the beam, bending strain is produced. The resisting moment is developed by internal stresses. Under positive moment, compressive strains are produced in the top of beam and tensile strains in the bottom. Concrete is a poor material for tensile strength and it is not suitable for flexure member by itself. The tension side of the beam would fail before compression side failure when beam is subjected a bending moment without the reinforcement. For this reason, steel reinforcement is placed on the tension side. The steel reinforcement resists all tensile bending stress because tensile strength of concrete is zero when cracks develop

Beams are generally clarification of building or structural designing or civil engineering structural components. However, any structures, for example, car vehicle outlines, flying machine parts, machine outlines.

In engineering, there are several types of beams based on the supports which are Simply supported beam which a beam is supported on the ends that is allowed to rotate and have no moment resistance, fixed beam which a beam is supported on both ends and limited from rotation, over hanging which a simple beam extending toward its support on one side ,double overhanging which a simple beam with both ends extending beyond its supports on both ends, continuous beam or nonstop supports beam which a beam extending over more than two supports, cantilever beam which the beam is settled just toward one side and trussed beam which a beam is strengthened by adding a cable or rod to form a truss

Reinforced concrete is one of the modern building materials widely used. Concrete is an "artificial stone" obtained by mixing cement, sand, and aggregates with water. When aggregate is mixed together with dry Portland cement and water, the mix it forms fresh liquid of concrete that is easily poured and molded into any shape we want to get, which is an inherent advantage over other materials, the cement reacts chemically with the water and other components to form a hard matrix that binds the materials together into a durable stone-like material that has many uses. After the production of Portland cement, concrete became very popular around the world; however, its limited resistance to tension prevented its widespread use in building construction, to overcome this weakness, steel bars are included in concrete to form a composite material called reinforced concrete. The modern reinforced concrete design and construction practice were developed by European engineers in the late 19th century, nowadays the reinforced concrete is widely used in many range of engineering applications such as building, bridges and dams

In the late nineteenth century, reinforcing materials, such as iron or steel rods, began to be used to increase the tensile strength of concrete. Today steel bars are used as common reinforcing material. Usually steel bars have over 100 times the tensile strength of concrete; but the cost is higher than concrete. Therefore, it is most economical that concrete resists compression and steel provides tensile strength. Also, it is essential that concrete and steel deform together and deformed reinforcing bars are being used to increase the capacity to resist bond stresses.

Good structural analysis and design must be completed with appropriate reinforcement detailing to make sure that the whole structure acts as it designed by the designer.so the process of details and arrangement of the bar should be in the best way, practical, cost-effective, and suitable for their intended use, otherwise you may suffer from ugly cracks, excessive deflection, or even collapse because the poorly detailed structure

Flexural strength, which also known as modulus of rupture, or bend strength, or transverse rupture strength is a substance property, which is defined as stress in a material before it is produced in a bend test (Michael Ashby 2011) .Most often transverse bending test is used, in which we employ a rectangular or circular cross section that is bent until breaking or yield by using a three-point rupture of modulus test technique, the flexural strength is the highest pressure occurs within the material at its moment of yield, this is measured in terms of stress.

when the shape of an any object is a single material such as steel bar or wooden beam, it is faces a range of pressures through its depth, the stress will be at its maximum pressure value if the state of the edge is concave face means that the edge of the object is on the inside of the bend, on the other hand the stress will be at its maximum tensile value if the pressure at the outside of the bend which means convex face, These internal and external edges of the beam or rod are known as the 'extreme fibers'. The majority of substances fail under tensile stress before they fail under pressure stress, so the transverse rupture strength (bend strength) is the maximum value of tensile stress that can be sustained before the beam fails.

The flexural strength of a material is defined as its ability to resist deformation under load. For materials that deform significantly but do not break, the load at yield, typically measured at 5% deformation/strain of the outer surface, is reported as the flexural strength or flexural yield strength. The test beam is under compressive stress at the concave surface and tensile stress at the convex surface.

REFERENCES

Birgisson, s. r. (2011). shear resistance of reinforced concrete beams without stirrups.

Ching, F. (1995). A visual dictionary of architecture. New York: Van Nostrand Reinhold, 8-9.

Choi, K.-K. (May 2002). Reinforced Concrete Structure Design Assistant Tool.

Co, J. R. (1888). Flexural Strength Testing of Plastics. (n.d.). MATWEB. The American Architect and Building News. Boston.

Cook, M. D., Ley, M. T., & Ghaeezadah, A. (2014). A workability test for slip formed concrete pavements.Construction and Building Materials, 68, 376–383.

Ghannoum, W. M. (November 1998). Size Effect On Shear Strength Of Reinforced Concrete Beams. International Journal of Physical Science.

Harcourt, P. (2012). Flexural And Tensile Strength Properties Of Concrete Using Lateritic Sand And Quarry Dust As Fine Aggregate, 7(3), 324–331.

Int, R. (April 2014). Review on Shear Behaviour of Reinforced Concrete Beam. Journal of Engineering Research and Applications. (Vol.ELSEVIER). Pradesh , India.

Ismail, S., Hoe, K. W., & Ramli, M. (2013). Sustainable Aggregates: The Potential and Challenge for Natural Resources Conservation. Procedia Social and Behaviora Sciences, 101(February 2014), 100–109.

Matta, F. (2007). Size effect on shear strength of concrete beams reinforced with FRP bars.

Mohamed, N. F. (n.d.). Th Effects of Inclined Shear Reinforcement in Reinforced Concrete. Kerala , India:American Society of Civil Engineers.

Moayyad M. Al-Nasra 1, N. M. (2013). Shear Reinforcements in the Reinforced Concrete Beams. American Journal of Engineering Research (AJER), 191.

Moore, W. M. (2010). Concrete works. Building Rural Roads, 388–466.

Neil M. Hawkins, D. A. (July 2005). Simplified Shear Design of Structural Concrete Members . Urbana, Illinois : National Cooperative Highway Research Program.

Nielsen, K. E. (1 Mar 1954). Effect of various factors on the flexural strength of concrete test beams. Magazine of Concrete Research,. Reinforced Concrete. (1916). America's cement manufactures.

Rakshith, A. (2013). Strength and Permeability Characteristics. Kerala , India: American Society of Civil Engineers.

Rizkalla, D. S. (2007). Behavior of High Performance Steel as Shear Reinforcement. Concrete. International Journal of Scientific & Engineering Research, 3(7), 3–7.

Standard, B. (1983). BS 1881 :Partlll: 1983.

Standard, B. (1983). Testing concrete.

Standard, I. (2009). Testing hardened concrete – Part 3 : Compressive strength of test specimens.

Yakut, A. (n.d.). Middle East Technical University . Turkey.

Zongjin. (2011). Advanced concrete technology.

Testing concrete. (1983).

Younoussa Millogo (2013). Comparison of Performance of Standard Concrete Brazil: Journal of Scientific & Engineering Research.